

LISTING OF THE CLAIMS

At the time of the Action:

Pending Claims: 1-35, 37-40

Canceled Claim: 36

After this Response:

Pending Claims: 1-33

Amended Claims: 1, 11, 13, 22, 32

Canceled Claims: 34-40

1. (Currently Amended) A computer-implemented method performed by a computing device that has one or more processors to execute instructions, the method comprising:
~~determining a bid term, the bid term associated with multi-type data objects;~~
identifying intra-layer relationships among ~~homogeneous objects of the multi-type~~ data objects based on user interaction with the multi-type data objects, wherein the intra-layer relationships are ~~based on an interconnections~~ between the multi-type data objects of the ~~a same type in a homogeneous group of~~ based on attributes directly associated with the multi-type data objects;
identifying inter-layer relationships among ~~heterogeneous objects of the multi-type~~ data objects based on the user interaction with the multi-type data objects, wherein the inter-layer relationships are ~~based on an interconnections~~ between the multi-type data objects of different types in a heterogeneous group of ~~rather than attributes directly associated with the multi-type data objects;~~

iteratively, ~~by a reinforced clustering algorithm,~~ clustering the multi-type data objects by the intra-layer relationships and the inter-layer relationships to generate reinforced clusters; ~~and~~

~~utilizing, by a search term suggestion module, the reinforced clusters to respond to the bid term from a user with search terms relevant to the bid term.~~

generating a list of search terms associated with a bid term using the reinforced clusters, the search terms generated in response to receiving the bid term from a user;
and

storing the list of search terms on a computer readable storage media.

2. (Previously Presented) The method of claim 1, wherein the inter-layer relationships include at least one of content related information, user interest in an associated topic, and user interest in an associated Web page.

3. (Previously Presented) The method of claim 1, wherein the intra-layer relationships include at least one of query refinement, recommended Web page, and relationship between respective users.

4. (Previously Presented) The method of claim 1, wherein each of the multi-type data objects are related to at least one of a search query data object type, a selected Web page type, and a user information type.

5. (Previously Presented) The method of claim 1, wherein the inter-layer relationships include a first weighting scheme and the intra-layer relationships include a second weighting scheme different than the first weighting scheme to indicate importance to associated objects of the multi-type data objects.

6. (Previously Presented) The method of claim 1, wherein the identifying and the iteratively clustering are performed for search term suggestions.

7. (Previously Presented) The method of claim 1, wherein the iteratively clustering comprises propagating clustering results of a first iteration to all related data objects of the multi-type data objects, at least two of the related data objects being of heterogeneous data type, the propagating being used to enhance clustering of respective ones of the multi-type data objects in a second iteration of reinforced clustering operations.

8. (Previously Presented) The method of claim 1, wherein the iteratively clustering comprises determining a similarity between individual ones of the multi-type data objects, the similarity being a function of at least one of inter-object and intra-object content similarity and similarities between the inter-layer relationships and the intra-layer relationships.

9. (Previously Presented) The method of claim 1, wherein the iteratively clustering comprises merging related ones of the multi-type data objects to reduce feature space dimensionality of the related ones.

10. (Previously Presented) The method of claim 1, wherein the method further comprises mutually reinforcing an importance of individual ones of the multi-type data objects within an object type and between different object types.

11. (Currently Amended) A computer-implemented method performed by a computing device that has one or more processors to execute instructions, the method comprising:

~~identifying relationships between multi-type data objects, wherein the multi-type data objects comprise~~ that include at least one object of a first type and at least one object of a second type different from the first type, ~~the relationships being at least one of intra-layer relationships or inter-layer relationships among the multi-type data objects based on user interaction with the multi-type data objects;~~

~~iteratively clustering the multi-type data objects in view of respective ones of~~ based on the relationships to generate reinforced clusters;

~~utilizing, by a search term suggestion component, the reinforced clusters to respond to a search query from a user with terms relevant to the search query;~~

generating a list of search terms associated with a bid term using the reinforced clusters, the search terms generated in response to receiving the bid term from a user;

storing the list of search terms on a computer readable storage media; and

mutually reinforcing an importance of individual ones of the multi-type data objects within an object type and between different object types based on the following:

$$\left\{ \begin{array}{l} a(X) = \beta L_X^T h(X) + (1 - \beta) L_{XY} i(Y) \\ h(X) = \beta L_X a(X) + (1 - \beta) L_{XY} i(Y) \\ i(X) = a(X) + h(X) \\ a(Y) = \gamma L_Y^T h(Y) + (1 - \gamma) L_{YX} i(X) \\ h(Y) = \gamma L_Y a(Y) + (1 - \gamma) L_{YX} i(X) \\ i(Y) = a(Y) + h(Y) \end{array} \right.$$

wherein $X = \{x_1, x_2, \dots, x_m\}$ and $Y = \{y_1, y_2, \dots, y_n\}$ represent respective object sets of heterogeneous object type with relationships R_X , R_Y , R_{XY} and R_{YX} if directionality is considered, L_X and L_Y represent adjacent matrixes of links identifying relationships within set X and Y respectively, L_{XY} and L_{YX} represent adjacent matrixes of links identifying relationships from objects in X to objects in Y , $a(X)$ and $h(X)$ are an authority score and a hub score of nodes within X respectively, $a(Y)$ and $h(Y)$ respectively represent authority scores and hub scores of nodes in Y , $i(X)$ and $i(Y)$ respectively represent an importance of the nodes in X and Y , and β and γ are weight parameters to adjust influence of links derived from different relationships.

12. (Previously Presented) The method of claim 1, wherein the utilizing the reinforced clusters comprises:

responsive to receiving the bid term from a user, comparing the bid term with a feature space of objects in the reinforced clusters;

responsive to comparing, identifying one or more search term suggestions; and

communicating the search term suggestions to the user.

13. (Currently Amended) A computing device comprising:
a processor; and
a memory coupled to the processor, the memory comprising computer-program instructions executable by the processor for:
identifying relationships among multi-type data objects, wherein
the identified relationships include intra-layer relationships and inter-layer relationships such that:

the intra-layer relationships are among a homogeneous group objects—of the multi-type data objects having an interconnection based on user interaction with the attributes directly associated with multi-type data objects, and

the inter-layer relationships are among a heterogeneous group objects—of the multi-type data objects having an interconnection based on the user interaction with between heterogeneous objects of different types rather than attributes directly associated with the multi-type data objects;

iteratively clustering the multi-type data objects by at least one of the identified relationships to generate reinforced clusters, each relationship of the identified relationships being weighted to indicate an importance ~~to~~ associated objects of the multi-type data objects; and

~~utilizing, by a search term suggestion module, the reinforced clusters to respond to a bid term from a user with search terms relevant to the bid term, generating a list of search terms associated with a bid term using the reinforced clusters, the search terms generated in response to receiving the bid term from a user.~~

14. (Previously Presented) The computing device of claim 13, wherein the inter-layer relationships include at least one of content related information, user interest in an associated topic, and user interest in an associated Web page.

15. (Previously Presented) The computing device of claim 13, wherein the intra-layer relationships include at least one of query refinement, recommended Web page, and relationship between respective users.

16. (Previously Presented) The computing device of claim 13, wherein identifying and iteratively clustering are performed for search term suggestion.

17. (Previously Presented) The computing device of claim 13, wherein the computer-program instructions for the iteratively clustering comprise instructions for aggregating data object relationships to related ones of the multi-type data objects based on content of the reinforced clusters.

18. (Previously Presented) The computing device of claim 13, wherein the instructions for the iteratively clustering comprise instructions for determining a similarity between individual ones of the multi-type data objects, the similarity being a function of at least one of inter-object and intra-object content similarity and similarities between the at least one of the identified relationships.

19. (Previously Presented) The computing device of claim 13, wherein the instructions for the iteratively clustering comprise instructions for merging related ones of the multi-type data objects to reduce feature space dimensionality of the related ones.

20. (Previously Presented) The computing device of claim 13, wherein the instructions for the iteratively clustering comprise instructions for iteratively clustering until all object types represented by the multi-type data objects converge.

21. (Previously Presented) The computing device of claim 13, wherein the utilizing the reinforced clusters comprises:

responsive to receiving the bid term from a user, comparing the bid term with a feature space of objects in the reinforced clusters;

responsive to comparing, identifying one or more search term suggestions; and
communicating the search term suggestions to the user.

22. (Currently Amended) A computer-readable storage medium comprising computer-executable instructions executable by a processor for:

identifying intra-layer relationships and inter-layer relationships among multi-type data objects, wherein the intra-layer relationships are among a homogeneous group objects of the multi-type data objects having an interconnection based on user interaction with the attributes directly associated with multi-type data objects, and wherein the inter-layer relationships are among a heterogeneous group objects of the multi-type data objects having an interconnection based on the user interaction with ~~between heterogeneous objects of different types rather than attributes directly associated with~~ the multi-type data objects;

iteratively clustering the multi-type data objects by at least one of the identified relationships to generate reinforced clusters; and

~~utilizing, by a search term suggestion module, the reinforced clusters to respond to a bid term from a user with terms relevant to the bid term.~~

generating a list of search terms associated with a bid term using the reinforced clusters, the search terms generated in response to receiving the bid term from a user.

23. (Previously Presented) The computer-readable storage medium of claim 22, wherein the inter-layer relationships comprise at least one of content related information, user interest in an associated topic, and user interest in an associated Web page.

24. (Previously Presented) The computer-readable storage medium of claim 22, wherein the intra-layer relationships comprise at least one of query refinement, recommended Web page, and relationship between respective users.

25. (Previously Presented) The computer-readable storage medium of claim 22, wherein each of the multi-type data objects are related to at least one of a search query data object type, a selected Web page type, and a user information type.

26. (Previously Presented) The computer-readable storage medium of claim 22, wherein the at least one of the identified relationships are weighted to indicate an importance to associated objects of the multi-type data objects.

27. (Previously Presented) The computer-readable storage medium of claim 22, wherein identifying and iteratively clustering are performed for search term suggestion.

28. (Previously Presented) The computer-readable storage medium of claim 22, wherein the iteratively clustering comprises propagating clustering results of a first iteration to all related data objects of the multi-type data objects, at least two of the related data objects being of heterogeneous data type, the propagating being used to enhance clustering of respective ones of the multi-type data objects in a second iteration of reinforced clustering operations.

29. (Previously Presented) The computer-readable storage medium of claim 22, wherein the iteratively clustering comprises determining a similarity between individual ones of the multi-type data objects, the similarity being a function of at least one of object content similarity and similarities between the at least one of the identified relationships.

30. (Previously Presented) The computer-readable storage medium of claim 22, wherein the iteratively clustering comprises merging related ones of the multi-type data objects to reduce feature space dimensionality of the related ones.

31. (Previously Presented) The computer-readable storage medium of claim 22, wherein the instructions further comprise instructions for mutually reinforcing an importance of individual ones of the multi-type data objects within an object type and between different object types.

32. (Currently Amended) A computer-readable storage medium comprising computer-executable instructions executable by a processor for:

identifying at least one of intra-layer and inter-layer relationships among multi-type data objects, wherein the multi-type data objects comprise at least one object of a first type and at least one object of a second type different from the first type;

iteratively clustering the multi-type data objects by at least one of the relationships to generate reinforced clusters;

~~utilizing, by a search term suggestion module, the reinforced clusters to respond to a bid term from a user with terms relevant to the bid term;~~

generating a list of search terms associated with a bid term using the reinforced clusters, the search terms generated in response to receiving the bid term from a user;

and

mutually reinforcing an importance of individual ones of the multi-type data objects within an object type and between different object types based on the following:

$$\begin{cases} a(X) = \beta L_X^T h(X) + (1 - \beta) L_{XY} i(Y) \\ h(X) = \beta L_X a(X) + (1 - \beta) L_{XY} i(Y) \\ i(X) = a(X) + h(X) \\ a(Y) = \gamma L_Y^T h(Y) + (1 - \gamma) L_{YX} i(X) \\ h(Y) = \gamma L_Y a(Y) + (1 - \gamma) L_{YX} i(X) \\ i(Y) = a(Y) + h(Y) \end{cases}$$

wherein $X = \{x_1, x_2, \dots, x_m\}$ and $Y = \{y_1, y_2, \dots, y_n\}$ represent respective object sets of heterogeneous object type with relationships R_X , R_Y , R_{XY} and R_{YX} if directionality is considered, L_X and L_Y represent adjacent matrixes of links identifying relationships within set X and Y respectively, L_{XY} and L_{YX} represent adjacent matrixes of links identifying relationships from objects in X to objects in Y , $a(X)$ and $h(X)$ are an authority score and a hub score of nodes within X respectively, $a(Y)$ and $h(Y)$ respectively represent authority scores and hub scores of nodes in Y , $i(X)$ and $i(Y)$ respectively represent an importance of the nodes in X and Y , and β and γ are weight parameters to adjust influence of links derived from different relationships.

33. (Previously Presented) The computer-readable storage medium of claim 22, wherein utilizing the reinforced clusters comprises:

responsive to receiving the bid term from a user, comparing the bid term with a feature space of objects in the reinforced clusters;

responsive to the comparing, identifying one or more search term suggestions;
and

communicating the search term suggestions to the user.

34-40. (Canceled)